Unit 03: Intermolecular Forces and Properties

Content Area:
Course(s):
Time Period: **Year**
Length: **180**
Status: **Published**

Unit 3

Unit Title:	Intermolecular Forces and Properties
Suggested Duration:	**Five weeks**

Interdisciplinary Connections

Interdisciplinary Connections
Reading and Writing Companion Standards for History, Social Studies, Science and Technical Subjects ▪ Grades 9-10 ▪ Grades 11-12 **Math Practices**: https://www.nj.gov/education/standards/math/Index.shtml **Science Practices**: https://www.nj.gov/education/standards/science/Index.shtml Find and paste appropriate Companion Standards or Practices here.

Mathematics—Metric conversions, solving for an unknown, interpreting graphs
Language Arts- Reading scientific documents for comprehension, writing conclusions, writing lab reports
Social Studies—Historical events leading to scientific discoveries and/or revisions
Foreign Language – Chemical nomenclature relates to the learning of any language

Technology Integration

Technology Integration
Northern supports the integration of the SAMR Model: a framework which extends learning through the use of technology. The installation of interactive boards, the purchase of softwares and subscriptions, and the investment in 1:1 laptops and various other instructional technologies are examples of Northern's commitment to enhancing students' learning and preparing the 21st century learner for college and careers.

- *Use of Atomic Emission Spectroscopes*
- Vernier Computer-based probes and software
- ViewBoard for presentation of information and interactive activities
- United Streaming/Discovery Education
- Laptops/Computer Lab—web based project
- AP Classroom.

Standard(s) Addressed

Course Skills

SAP-5.A Explain the relationship between the chemical structures of molecules and the relative strength of their intermolecular forces when: a. The molecules are of the b. The molecules are of two different chemical species.
SAP-5.B Explain the relationship among the macroscopic properties of a substance, the particulate-level structure of the substance, and the interactions between these particles.
SAP-6.A Represent the differences between solid, liquid, and gas phases using a particulatelevel model.
SAP-7.A Explain the relationship between the macroscopic properties of a sample of gas or mixture of gases using the ideal gas law.
SAP-7.B Explain the relationship between the motion of particles and the macroscopic properties of gases with: a. The kinetic molecular theory b. A particulate model. c. A graphical representation.
SAP-7.C Explain the relationship among non-ideal behaviors of gases, interparticle forces, and/or volumes.
SPQ-3.A Calculate the number of solute particles, volume, or molarity of solutions.
SPQ-3.B Using particulate models for mixtures: a. Represent interactions between components. b. Represent concentrations of components.
SPQ-3.C Explain the relationship between the solubility of ionic and molecular compounds in aqueous and nonaqueous solvents, and the intermolecular interactions between particles.
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SAP-8.A Explain the relationship between a region of the electromagnetic spectrum and the types of molecular or electronic transitions associated with that region.
SAP-8.B Explain the properties of an absorbed or emitted photon in relationship to an electronic transition in an atom or molecule.
SAP-8.C Explain the amount of light absorbed by a solution of molecules or ions in relationship to the concentration, path length, and molar absorptivity

STAGE I Desired Results

<table>
<tr><th colspan="2">STAGE I Desired Results</th></tr>
<tr><th colspan="2">Objective (Transfer)</th></tr>
<tr><td colspan="2">Transformations of matter can be observed in ways that are generally categorized as either a chemical or physical change. The shapes of the particles involved and the space between them are key factors in determining the nature of physical changes. The properties of solids, liquids, and gases reflect the relative orderliness of the arrangement of particles in those states, their relative freedom of motion, and the nature and strength of the interactions between them. There is a relationship between the macroscopic properties of solids, liquids, and gases, as well as the structure of the constituent particles of those materials on the molecular and atomic scale. In subsequent units, students will explore chemical transformations of matter.</td></tr>
<tr><th colspan="2">Mastery</th></tr>
<tr><td>Big Ideas/Understandings

BIG IDEA 1: SCALE, PROPORTION, AND QUANTITY (SPQ)
Quantities in chemistry are expressed at both the macroscopic and atomic scale. Explanations, predictions, and other forms of argumentation in chemistry require understanding the meaning of these quantities, and the relationship

BIG IDEA 2: STRUCTURE AND PROPERTIES (SAP)
Properties of substances observable at the macroscopic scale emerge from the structures of atoms and molecules and the interactions between them. Chemical reasoning moves in both directions across these scales. Properties are predicted from known aspects of the structures and interactions at the atomic scale. Observed properties are used to infer aspects of the structures and interactions.</td><td>Essential Questions

How do interactions between particles influence mixtures?

Why does the smell of perfume only last a short time?

Why can you swim in water but you cannot walk through a wall?

How are the properties of gases described?

How can you determine the structure and concentration of a chemical species in a mixture?</td></tr>
<tr><th colspan="2">Acquisition</th></tr>
<tr><td>Students will know . . .

See “essential knowledge” in each topic of College Board CED for Unit 3</td><td>Students will be skilled at . . .

This unit requires students to draw upon claims made in Unit 2 about molecular geometry and polarity to support claims about intermolecular forces between molecules. Further, students will practice illustrating such claims by constructing particle representations of pure solids, liquids, gases, and solutions. This unit also requires</td></tr>
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	students to build proficiency with mathematical reasoning skills, essential for success in the remainder of the course. Students should be able to explain relationships between variables in an equation (e.g., the ideal gas law) and then estimate the approximate value of one variable within an equation when the value of another variable changes. Students will practice these skills when choosing and implementing experimental procedures, making observations, and/or collecting data to address a question. Students can then determine the accuracy and precision of the data as well as manipulate it with known mathematical equations to support their claims (e.g., concentration of a substance, properties of substances in a mixture).

STAGE II Assessment Evidence

STAGE II Assessment Evidence	
Common Summative Assessments	Common Formative Assessments
Tests Quizzes Laboratory Reports and analyses	Exit Slips Quizzes Homework Problems Participation in class discussions and in performance of lab experiments Laboratory notebook AP Classroom Unit checks
Modifications	
How are the evaluations/assessments modified/accelerated? (i.e.: alternate assessment). All courses follow a balanced assessment system with Practice, Assessments, Evaluations.	

Modifications on 504 plans may be submitted at (SSD). prior to testing. Both exclusion statements and extensions exist for each standard to accommodate different paces.

STAGE III Learning Plan

STAGE III Learning Plan
Organize plan by weeks
3.1 Intermolecular Forces 3.2 Properties of Solids 3.3 Solids, Liquids, and Gases 3.4 Ideal Gas Law 3.5 Kinetic Molecular Theory 3.6 Deviation from Ideal Gas Law 3.7 Solutions and Mixtures 3.8 Representations of Solutions 3.9 Separations of Solutions and Mixtures Chromatography 3.10 Solubility 3.11 Spectroscopy and the Electromagnetic Spectrum 3.12 Photoelectric Effect 3.13 Beer-Lambert Law
Modifications
How are the activities modified/differentiated? (i.e.: abridged text)

Modifications on 504 plans may be submitted at (SSD). prior to testing. Both exclusion statements and extensions exist for each standard to accommodate different paces.

Specific Resources for Unit

Specific Resources for Unit
Attached Affirmative Action Compliance Checklist

Selected College-Board practice problems
Chang, Raymond and Goldsby, Kenneth A. Chemistry, 13th Edition. New York, McGraw-Hill. 2019
The College Board. AP Chemistry Guided Inquiry Experiments: Applying the Science Practices. 2013.
Demmin, Peter and David Hostage. AP Chemistry, Fifth Edition. New York: D&S Marketing Systems, Inc., 2005
Vonderbrink, Sally. Laboratory Experiments for Advanced Placement Chemistry. Batavia: Flinn Scientific, 2001.
POGIL Activities for High School Chemistry, Batavia: Flinn Scientific, 2012,
AP Classroom

Diversity, Equity, & Inclusion

Diversity, Equity &Inclusion
Provide a brief description of how this unit addresses DE&I.

Career Readiness (9.2), Life Literacies and Key Skills (9.4) Standards

WRK.K-12.P.1	Act as a responsible and contributing community members and employee.
WRK.K-12.P.2	Attend to financial well-being.
WRK.K-12.P.3	Consider the environmental, social and economic impacts of decisions.
WRK.K-12.P.4	Demonstrate creativity and innovation.
WRK.K-12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
WRK.K-12.P.6	Model integrity, ethical leadership and effective management.
WRK.K-12.P.7	Plan education and career paths aligned to personal goals.
WRK.K-12.P.8	Use technology to enhance productivity increase collaboration and communicate effectively.
WRK.K-12.P.9	Work productively in teams while using cultural/global competence.

Climate Change Education

ClimateChange Education	
Enduring Understandings/Core Ideas	Performance Expectations
Math and ELA- Provide a brief description of a lesson or activity that relates to Climate Change. All other Content Team copy and paste the Core Idea and Performance Expectation from NJDOE link above.	